

TITLE OF THE INVENTION WEB PRINTERS

BACKGROUND OF THE INVENTION

Field of the Invention

5 The present invention relates to web printers that form images on the webs carried at high speed.

Related Background Art

10 In the general types of printers that form images on webs, the pin members of the tractor mechanism mounted on the printer are engaged with the feed holes of the web and the tractor mechanism is driven to feed the web and form an image thereon using the image forming section of the printer. After the web with the feed holes has been printed, however, these feed holes
15 (usually, the left and right edges of the web) need to be cut and thus a time is spent in obtaining the final printed matter. Also, the printer itself requires a tractor mechanism as its mandatory component, and absolutely needs to take a complex configuration. Such
20 cutting operation as mentioned above can be omitted by adopting webs free of feed holes, using a tractor mechanism, instead of the web feeder of the printer, and providing a web feed roller mechanism.

25 By the way, for a printer that uses webs free of feed holes and forms an image on a web while feeding

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it by use of a feed roller mechanism, if this printer is of the type up to a middle-speed region in which only about 50 pages per minute can be printed on an A4-paper horizontal feed basis, printing not
5 conspicuous in terms of print position offsets is possible since not too significant slipping occurs between the web and the feed rollers. If, however, the printer is of the high-speed region type capable of printing more than 100 pages per minute or is of the
10 ultrahigh-speed region type capable of printing more than 200 pages per minute, it is difficult under the conventional configuration to feed the web to the image forming section accurately, and even when such extremely thin paper as used for a dictionary, for
15 example, is fed at a rate as high as more than 100 pages per minute, the need arises to control very accurately the tension, traveling position, etc. of the web being fed.

20 SUMMARY OF THE INVENTION

The object of the invention is to provide a printer that enables, irrespective of the web type, stable feed of the web at high speed and with high accuracy.

25 The object set forth above can be achieved by

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a buffer means for adjusting the traveling position of the web under its slack status,

a tension assigning means for assigning fixed

a means for detecting the traveling position of the web delivered from said tension assigning means

a skew correction means for adjusting the skew of said web according to the output from said detection means, and

an image forming means that forms images on the web delivered from said skew correction means.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a total block diagram of the printer shown as an embodiment of the present invention.

Figure 2 is a view showing the configuration of the control section in the embodiment of Fig. 1.

Figure 3 is a total block diagram of another embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

An embodiment of the present invention is described below using drawings. Figure 1 is a schematic diagram showing an embodiment of the printer

pertaining to the present invention.

Numeral 1 in Fig. 1 denotes a web. Web 1 may be made from paper, a plastic film, or the like. Web 1 is inducted into a buffer unit 4 via guide rollers 2 and 3 arranged on the web feed route; the guide roller 2 being connected to a motor 2b via a timing belt 2a and rotationally driven at a surface velocity higher than the feed rate of web 1 and in the same direction as the feed direction of the web.

The buffer unit 4 is equipped with a storage portion 4a for temporarily storing the web 1 fed, one pair of rollers 4b and 4c provided at the web loading section with respect to the storage portion 4a,

one pair of rollers 4d and 4e provided at the web unloading section with respect to the storage portion 4a,

motors 4f and 4g for driving the rollers 4b and 4e, respectively, and

a plurality of sensors (in this embodiment, three pairs of optical sensors 4h, 4i, and 4j) for monitoring the amount of slack of the web 1 in the storage portion 4a,

and controls the rotational speeds of the rollers 4b and 4e via the motors 4f and 4g according to the particular output of each sensor so that the amount of

slack of the web 1 in the storage portion 4a is restricted to stay within a predetermined allowable range. wherein it is desirable that the roller 4e and the motor 4g be provided so as to keep constant the torque generated and conduct stable control of the torque required for the rotation of the roller 4e.

In the vicinity of the rollers 4d and 4e located at the web unloading section of the buffer unit 4 is provided a guide member 4k that restricts the edge positions of the web 1 fed, wherein, since the guide member 4k acts on the web existing under a stack status, the traveling position of the web 1 in contact with the guide member 4k is easily adjusted. In this embodiment, the guide member 4k is provided so that the skewing width in the feed direction of the web can be restrained with a maximum margin of about 1 mm during the start of feed (this margin during stabilized feed can be about 0.5 mm). The tension of the web 1 at the initial phase of its feed is determined by the torque generated at the roller 4e and the take-up angle of the web with respect to guide roller (fixed roller) 5, and the lateral skew angle of the web can be restrained to a certain extent.

After web 1 has been pulled out from the buffer unit 4, the web is fed into a tension assigning unit 6

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document). That is to say, an image forming section 10 intervenes between the infeed roller 6c and the outfeed roller 15c, and this means that if highly accurate tension control cannot be conducted at the dancer roller 6e, the printer will pose the fatal problem that image components of each color are transferred under a position-offset status on the web. In this embodiment, therefore, the tension of the web 1 between the infeed roller 6c and the outfeed roller 15c is adjusted by the dancer roller 6e so as to stay within the range from 30 to 200 N, depending on the ream weight and width of the print paper.

After that, the web 1 that was pulled out from the tension assigning unit 6 is fed into a skew correction unit 8 via a guide roller 7. The skew correction unit 8 is composed of two position-restricting rollers 8a and 8b provided in parallel, a sensor 8c for detecting the edge position of the web 1, and a driving motor 8d. The two position-restricting rollers 8a and 8b are supported so that they can be rotationally moved under their parallel status by a frame 8d, and these rollers are provided so that both can be inclined together to the required angle by rotating the frame 8d through an angle based on the output level of the sensor 8c.

The web 1 that has been passed through the skew

correction unit 8 is fed into the image forming
section 10 via a guide roller 9. Although the present
invention does not limit the use of the image forming
section 10, this embodiment exemplifies an image
5 forming section of the type which forms toner images
on the photosensitive material by use of known
electrophotographic processes, and shows the
configuration where color images are formed on one
side of the web 1 by four imaging portions, 10a, 10b,
10 10c, and 10d.

The structure of the imaging portions is described
below taking imaging portion 10a as an example.
Numeral 101 in the figure denotes a photosensitive
material belt. When the photosensitive material belt
15 101 starts rotating, a high voltage is applied to a
corona charger 102 and the surface of the
photosensitive material belt 101 is uniformly charged.
The laser beam that has been emitted from a light
source 103 including a semiconductor laser, photo-
20 emitting diodes, etc., provides the surface of the
photosensitive material belt 101 with image exposure
and forms an electrostatic latent image on the
photosensitive material belt 101. When the
photosensitive material belt area holding this latent
25 image reaches a position that faces a image developing

unit 104, a developing agent is supplied to the electrostatic latent image and a toner image is formed on the photosensitive material belt 101. The toner image that has been formed on the photosensitive material belt 101 is attracted onto web 1 by the action of a transfer unit 105 by which a charge of opposite polarity to that of the toner image is assigned to the reverse side of web 1. The area that has passed the transfer position of the photosensitive material belt 101 is cleaned by a cleaning unit 106 in order to prepare for the next printing operation.

After, in the way described above, the toner image has been transferred from the four imaging portions, 10a, 10b, 10c, and 10d, to web 1, the toner image is fixed by the passage of the web through a heater 11 and the web is unloaded from the printer via guide rollers 12, 13, and 14, an outfeed roller mechanism 15, and a puller 16. After this, the web is carried to a post-processor (not shown in the figure), where the printer then performs the required processes, such as cutting, stapling, and punching, on the web in order to complete the series of operations. In this embodiment, the outfeed roller mechanism 15 is constructed similarly to the infeed roller mechanism mentioned earlier in this document, and consists of an

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6e (that is to say, the tension of the print paper)
constant.

5 The driving motor 8d of the skew correction unit 8
is driven according to the particular output level of
the paper edge detection sensor 8c, and controls the
position of the paper unloaded from the skew
correction unit 8. Thus, the position of the paper fed
to the image forming unit 10 is maintained stably.

10 The number of slits in the encoder 18g of a speed
detection roller 18 during a fixed time is counted by
a slit counting section 102. The speed of the outfeed
motor 15a is changed according to the particular count
value in order to minimize the effects of the
constriction of the paper at fixing section 11 and the
15 effects of increases in the circumferential speed of
the outfeed roller 15c, associated with the heating of
the outfeed roller. That is to say, the effects of the
heat generated by the fixing section 11 can be
suppressed by changing the speed of the outfeed motor
20 15a.

The heater 11 has a plurality of heating plates so
that it can supply thermal energy to web 1, and this
heater maintains its internal air temperature in the
range from 150 to 350 degrees C and heats the web 1.
25 If the image forming section uses ink jet processing,

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not electrophotographic processing, the heater 11 can be used as a means of drying the ink image recorded and formed on the web 1 during ink jet processing, and the internal air temperature of the heater 11 in that case is managed to stay within the range from about 40 to 150 degrees C. Numeral 16a in Fig. 1 denotes the motor for driving the roller which constitutes the puller 16, and similarly, numerals 17 and 18 denote the pressure roller and the speed detection roller, respectively, wherein the pressure roller 17 and the speed detection roller 18 are constructed as the so-called "coupled rotating rollers" that rotate simultaneously when coming into contact with the web 1 fed to both. Also, the rotating shaft of the speed detection roller 18 has a slit-provided disc (encoder 18g) and is so constructed as to detect the corresponding slits by use of optical sensors or the like. And the rotational speed of the outfeed roller 15c is controlled by the control section 100 of the printer in accordance with the output signals of the above-mentioned optical sensors within a preset period, and thus the tension of the web passed through the image forming unit 10 is controlled. That is to say, when a signal meaning that the feed status of the web has been detected in its delay direction is obtained

from the speed detection roller 18, the rotational speed of the outfeed roller 15c is increased, and in the opposite case, the rotational speed of the outfeed roller 15c is reduced.

5 According to the printer of the above configuration, since web tension between the infeed roller 6c and the outfeed roller 15c is controlled by the dancer roller 6e and thus the feed of the web 1 passed through the image forming section 10 can be
10 stabilized, high-quality color printing not prone to shifting in terms of image position can be implemented.

 Although the description made above assumes a configuration in which four imaging portions are arranged in line on one side of the web, four imaging
15 portions can also be arranged on the other side of the web to apply the present invention to a printer capable of forming color images on both sides of the web. In this case, arranging at alternately different height levels the four imaging positions provided on
20 one side of the web 1, namely, 10a, 10b, 10c, and 10d, and the four imaging positions provided on the other side of the web 1, namely, 10e, 10f, 10g, and 10h, as shown in Fig. 3, enables the printer to be practical because the height of the printer can be prevented
25 from increasing too greatly and because its design can

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be made compact.

As set forth above, according to the present invention, high-speed and highly accurate feed of the web passed through the image forming means can be
5 stabilized, irrespective of the web type, since the web printer has

a buffer means for adjusting the traveling position of the web under its slack status,

10 a tension assigning means for assigning fixed tension to the web delivered from said buffer means,

a means for detecting the traveling position of the web delivered from said tension assigning means,

15 a skew correction means for adjusting the skew of said web according to the output from said detection means, and

an image forming means that forms images on the web.

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